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WaterLine

A publication about Ontario's water and wastewater industry.

A Microbiology Lab ... on Your Desktop

Ontario facility hosts technology trial

Biological contaminants such as *E. coli* and total coliforms can pose health risks to our water systems. Currently, testing for these pathogens involves a time-consuming and costly process of shipping samples to third-party labs for analysis.

But thanks to some advanced portable technology, this process could be much faster and simpler in the future.

There are some real innovations being made in the area of mobile pathogen detection by companies such as Early Warning Inc. (located in Waterloo) and Pathogen Detection Systems or PDS (located in Kingston). This technology is paving the way for microbiological testing that can be done on-site and in a fraction of the time and cost of outsourced lab work. The Desktop Testing Unit (DTU) from PDS, for example, uses a licensed detection process that was developed by Queens University following the Walkerton *E. coli* crisis in 2000.

The system includes:

- A desktop testing unit that weighs less than 9 kilograms
- Software that runs on an ordinary PC
- A supply of special pre-filled cartridges

Each cartridge contains a substrate that reacts to the enzymes released by pathogens in a water sample, producing a specific fluorescing response that indicates the nature and quantity of the pathogen. The patented structure of the cartridge and sensing system allows for quick, accurate tests from even the most turbid water samples.

This spring, thanks in part to a market-readiness grant from the **Ontario Centres for Excellence**, PDS conducted a three-week field test of the new system at the treatment facility in Carleton Place. As part of the trial, which was approved by both the Ministry of the Environment (MOE) and the local Health Unit, OCWA personnel were trained to operate the DTU and conducted all on-site tests. Each test sample was split, with half the sample going to a traditional off site lab, and half to the DTU.

"Staff found the unit very easy to use and convenient," says OCWA Operations Manager Brian Symondson. "We received results much quicker than normal, and the reports are good. The results were identical to the lab's, with the exception of the sewage plant effluents."

"This was primarily a trial of the treated water testing process," explains PDS spokesperson Peter Gallant. "We are now beginning to collect data from effluent samples that will allow us to calibrate the system accordingly. We'll soon be able to quickly test everything from treated and wastewater to beach and pool samples."

Other concerns about the absence of background testing (HPC) and online reporting on the test model are also being addressed by the company. Gallant expects solutions to be in place on the commercial model that PDS plans to release within the next 12 to 18 months.

The DT Unit is just the beginning for PDS' technology. "We're already discussing requirements with the Ministry for an in-line system," says Gallant. "It will eliminate the need for grab samples by providing operators with automated microbiology results on a scheduled or ad-hoc basis, just like turbidity and chlorine meters. Ultimately these tests will become part of the total water safety monitoring system."

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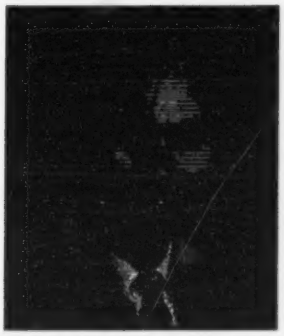


A message from Dan Atkinson, Vice President Operations, Southern Ontario, OCWA

"It can be easy to overlook the important roles that science and technology play in keeping our water supply safe."

The Science of Safe Water

Every day, millions of people around the world face the risks associated with sub-standard water quality. These potential dangers, primarily from water-borne diseases, pose significant threats to human health if left unchecked.

Living in Canada, with its seemingly limitless supplies of fresh water, it can be easy to overlook the important roles that science and technology play in keeping our water supply safe. In reality, the integrity of our drinking water supply depends upon the vigilance with which we test, treat and monitor it from source to tap.

In this issue of WaterLine, we look at the roles of science and technology in helping to ensure the quality of our water supply. In some instances, this technology is quite basic and has been with us for decades, as is the case with chlorination. But as water science continues to advance, we gain access to exciting new technologies that promise to help save time and increase efficiency. A prime example is in the area of testing for pathogens or biological contaminants. Traditionally, this process has been both time-consuming and costly, involving the shipping of samples and transmittal of results, sometimes over considerable distances. But promising new portable monitoring technology from several Ontario-based companies seems poised to make that testing process both quicker and less expensive in future.

Whatever the process involved, the ultimate objective is to ensure a safe, secure water supply for all Ontarians. And there are thousands of professionals at work throughout the province delivering on that promise every day. In this issue of WaterLine, we look at some of the work that is taking place behind the scenes – from 'The Life Cycle of a Water Sample' to the groundbreaking research underway at leading academic institutions, to the techniques employed to keep the pipes in distribution systems clean and safe.

We hope you find it informative.

Why chlorinate?

Simply put, we chlorinate to protect our health. Water-borne diseases such as cholera and typhoid fever make it imperative that our drinking water be completely and thoroughly disinfected. (In the early 1990s, inadequate disinfection of drinking water gave rise to a cholera epidemic in Peru and its neighbouring countries. This epidemic killed 40,000 people.)

All Ontario municipal water supplies are legally required to disinfect. Primary disinfection (treatment of source water, before it leaves the facility) can be achieved with chlorine compounds, ozone or even ultraviolet light. But secondary disinfection (treatment to prevent the reoccurrence of contamination during distribution via watermains) is achieved with chlorine compounds. Small residual amounts of the chemical remain in the water throughout the distribution network, minimizing bacterial regrowth and alerting operators to problems when the residuals drop below legislated levels.

Health Canada recently conducted a review of the use of chlorine in drinking water and found that the benefits of chlorinating our drinking water are much greater than any health risks from chlorination or its by-products. When combined with modern water filtration methods, chlorine is effective against virtually all microorganisms.

This doesn't mean that chlorination is completely without risk.

Chlorine reacts with organic matter in water to produce disinfection by-products such as trihalomethanes (THMs). Scientific studies have linked sustained exposure to high levels of THMs with an increased risk of some cancers, however, health experts insist that such risks are small and that the benefits of disinfection far outweigh the potential dangers.

It was one hundred years ago, in 1908, that North American cities first used chlorine to help provide safe water.

According to Health Canada, the level of THMs in drinking water should not exceed 100 parts per billion. The fact is that chlorine is used in the vast majority of Canada's 3,000 treatment plants but THMs are high only when the source water has high levels of organic matter that the treatment process does not adequately address.

"Biological contaminants are between 100,000 and 1 million times more dangerous than long-term exposure to disinfection by-products," says Rick Turnbull, an OCWA Compliance and Training Officer.

"THMs are closely monitored at all Ontario water facilities. Systems with levels approaching or above the guidelines are few and they receive close attention," says Turnbull, noting that chlorination remains the safest and most effective method of protecting the safety of Ontario's drinking water.

The **Life Cycle** of a Water Sample

Collection

A highly trained and certified operator **collects samples** on site, using specially-prepared containers that vary depending on the parameters to be analyzed and the sample locations. During the sampling process, the containers are clearly labelled and numbered.

The labs providing the containers ensure they are sterile and ready for use. Each container must be filled to specification: this much water, from this location, sealed and labelled in this way.

Shipping

The sample is typically received at the lab within 24 to 48 hours of collection. Each sample must be accompanied by a **Chain of Custody** form (COC) that records all information related to the sample: **who** collected it, **when**, **where** and under **what** conditions, and any related test results. The form must stay with the sample throughout its journey.

The sample must maintain a constant cool temperature established by the lab in order to ensure preservation of the contents, and must be secured in a sealed shipping container during transportation.

Testing

Once the sample is received at the lab, it is processed based on the type of tests to be performed. **Microbiological** testing is conducted immediately because timing is critical for the recovery and growth of microorganisms. **Chemical** test timings vary with the sample type, the analytical parameters, and the preservatives in the containers.

Test labs must be accredited and inspected semi-annually by the MOE.

Reporting

When the test result meets legislated criteria, the results are simply sent to the operator. If an adverse result is identified, however, the test results are faxed immediately to the operator, the appropriate Medical Officer of Health, and the MOE, prompting swift action to ensure the issue is investigated and addressed.

Proven Methods for Maintaining Water Quality and Pressure

Municipal watermains carry thousands of litres of water at high pressures every day. When coatings occur on the interior of mains, they reduce the network's capacity to handle high-usage volumes.

These coatings can include everything from oxidized metals to biofilm – a residue that can shelter bacteria.

"Managing these deposits is an important part of watermain maintenance," explains OCWA's Rick Turnbull. "Aside from capacity issues, iron coatings when disturbed can discolour the water and cause consumer complaints. And if biofilms are permitted to flourish, they may shelter bacteria from the normal free chlorine residuals maintained in the watermains. Research suggests free chlorine residuals several thousand times higher than normal are needed to inactivate the microorganisms."

Routine flushing of distribution system mains is typically practiced by most operating authorities. However, sometimes more vigorous methods are employed to recover carrying capacity.

One of the more common methods to help keep watermains clear is swabbing and flushing:

- Water pressure forces a wide swab through the watermain, scouring the accumulated sediment
- Mains are "flushed" through fire hydrants, washing out the loosened sediment
- A final step that is sometimes employed is the introduction of a chemical to help seal the internal surface of the water main

Flushing watermains is an effective way to help maintain the quality and clarity of municipal drinking water over the long-term. It's also an effective way to maintain adequate water pressure throughout the system. To help minimize service interruptions and mitigate potential risks associated with swabbing and flushing, it's important the work be done by experts with experience clearing similar networks.

Partners in Research

Science and technology play a vital role in the operation and safety of our water systems. That's why OCWA is proud to be a sponsor of the University of Waterloo's Research Chair in Water Treatment.

Canada's Research Chairs are promoted by the Natural Sciences and Engineering Research Council of Canada (NSERC), a federal body committed to making investments in people, discovery and innovation for the benefit of all Canadians. Over the last decade, the Council has invested over $10 billion in basic research and university-industry projects.

Dr. Peter Huck, Professor of Civil and Environmental Engineering at Waterloo, was recently renewed as the Water Treatment Research Chair for a fourth term, underscoring the important role research plays in promoting public health. Dr. Huck focuses on research that addresses the short- to medium-term needs of the funding partners.

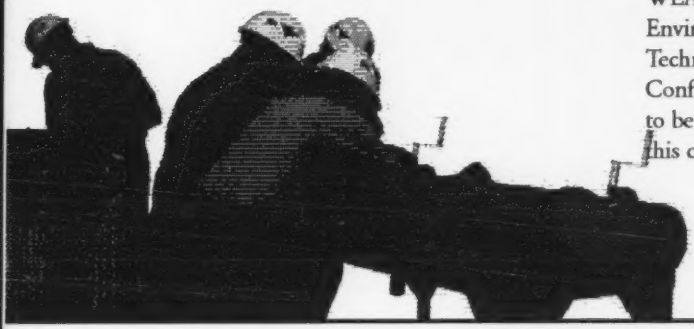
OCWA is one of 14 sponsors, along with various municipal governments and private industries. "This level of collaboration speaks to the critical role effective water treatment plays in public health and safety," says OCWA Research Coordinator Dr. Larry Moore.

OCWA has been a financial sponsor since the second term of the Chair. The Agency's continued involvement helps keep it informed of leading edge science and technology developments. This information is of value, particularly when exceptional challenges arise at one of the numerous water treatment systems OCWA operates for its clients.

NSERC CRSNG

left to right: The OCWA Jets are Alan Robdrup from the St. George WWTP, Marcel Misuraca from Stratford WWTP, coach Bev Mollard, OCWA Regional Manager for Western Ontario, Dennis Rau from Ailsa Craig WWTP and Mike Paola, from Stratford WWTP.

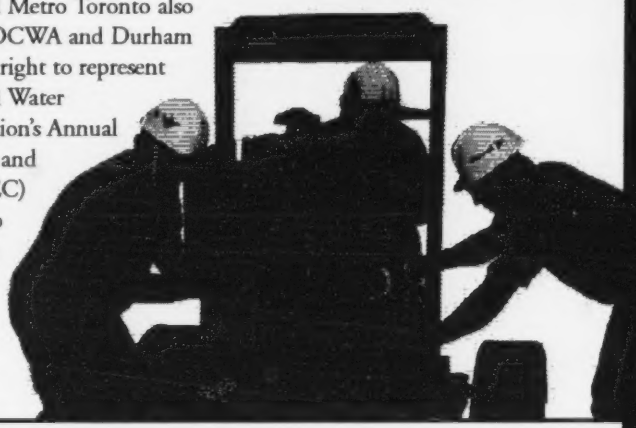
Below: At the Operations Challenge competition.



OCWA 1st in safety

2nd overall at Annual WEAO Operations Challenge competition

The OCWA Jets, competing at the Water Environment Association of Ontario (WEAO) Conference in Collingwood early in June took 2nd place overall and narrowly missed knocking off Durham Region for 1st place overall at the annual Operations Challenge competition. Teams from Windsor, Midland, Durham Region, and Metro Toronto also competed this year. OCWA and Durham have now earned the right to represent WEAO at the annual Water Environment Federation's Annual Technical Exhibition and Conference (WEFTEC) to be held in Chicago this coming October.



Breathe easy ... this is a green vehicle

After undertaking a careful assessment of available options, based on price, environmental friendliness, and working requirements, the Ontario Clean Water Agency has recently added the first hybrid vehicles to its fleet.

A couple of years ago Consumer Reports magazine concluded that payback on the extra premium for hybrids was several years away after purchase, if ever. But according to a recent article in the Toronto Star, times have changed. "The price of hybrids has come down; more hybrids are now available; and perhaps most significantly, the price of gasoline has increased more than 50 per cent." OCWA's data agreed.

The first vehicles in the OCWA fleet to go green are a Toyota Camry for Business Development in Toronto head office and a Ford Escape for the South Peel Facilities in Mississauga.

Hitting a high note

OCWA strongly believes that supporting clients is a goal achieved in many ways. Along with providing excellent operational services, participation in community events also demonstrates value to the communities we serve. As an example, this year OCWA is a proud contributor to the 81st Annual Peel Music Festival.

The Peel Music Festival was started in 1927 by W.E. Capps, a Brampton schoolteacher who wanted to create a competitive venue for school choirs. Today, over 80 years later, it has grown into one of Canada's largest and most respected music festivals, offering competitive adjudication to young performers playing a wide variety of instruments. A not-for-profit organization, run by a group of dedicated volunteer music teachers, the Festival attracted over 4,000 entries from area musicians last year and encourages many young professionals to further their education in the arts.

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